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ABSTRACT

The newsletter offers guidelines for adapting physical education classes to meet the needs of handicapped students. Adaptations should be within a student's ability range, allow a student to participate within guidelines established by his/her physician, allow a student to participate in the development of an adaptation and be positive toward its use, be constructed safely, and be made in activities appropriate to the student's age and interests. Specific teacher made adaptations are described and illustrated for archery, badminton, and table tennis. (SB)

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TEACHER-MADE ADAPTED DEVICES FOR ARCHERY, BADMINTON, AND TABLE TENNIS

by Jim Cowart*

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Students in physical education classes -- regular as well as adapted -- differ greatly in activity capabilities and limitations. To plan a program that is effective in assisting each student develop to his/her maximum capabilities is a worthy challenge for every physical education teacher. Through careful curriculum planning a teacher should be able to offer activities, generally with minimum modifications, appropriate to each pupil's needs. Such modifications may include adjusting rules, changing playing spaces, increasing the number of participants, and/or reducing playing time.

However, for some more functionally limited students such activity adjustments are not sufficient. A reasonable standard to determine appropriateness of an activity is whether or not a student can safely, successfully, and with personal satisfaction participate in that activity. If this standard is not attainable, specific equipment and/or device adaptations may be needed to assist the student in these physical activities. When planning such adaptations, consider carefully each student's capabilities, physician's activity guidelines, and safety, along with the student's interests and feelings. With such considerations likelihood of creating an adaptation that is functional, safe, and readily accepted by this student is greatly enhanced. Important considerations for developing adaptations follow.

GUIDELINES FOR MAKING ADAPTATIONS

Adaptations should be within a student's ability range. An adaptation should assist a student participate successfully in planned activities within his/her ability range. As a student's skill increases it may be necessary to modify further or eliminate an adaptation to encourage continued progress in student development.

Adaptations should allow a student to participate within guidelines established by his/her physician. Adaptations must be made that encourage a student to stay within activity limitations established by his/her physician while at the same time allowing the student freedom to participate within his/her ability. As a student uses an adaptation, attention must be given to possibilities of new problems being created. Since aggravation of other existing conditions is a possibility, frequent reevaluation of an adaptation as used by a specific student is necessary; appropriate adjustments are made when necessary.

A student should participate in the development of an adaptation and be positive toward its use. Cooperation between teacher and student is necessary for the development of a successful adaptation. The problem must be studied together to create a successful adaptation that overcomes a student's specific limitations. Ongoing appraisal regarding an adaptation's use is necessary for continued student acceptance.

Adaptations should be constructed safely. In planning and constructing a device adaptation, student safety must be upper most in a teacher's mind. An adaptation should encourage student participation yet be safe for the user as well as other students with whom he/she participates.

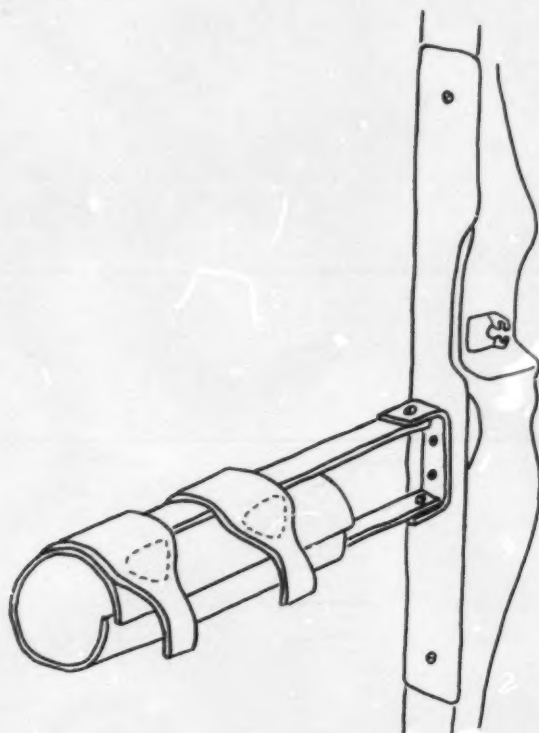
Adaptations should be made in activities appropriate to the student's age and interests. Each student should have opportunities to develop and use his/her abilities and capitalize personal interests. Since participation with non-disabled peers is a common desire, adaptations should be planned to encourage and allow this type participation.

In following sections, specific teacher-made adaptations for archery, badminton, and table tennis are described and illustrated. These adaptations were made following listed guidelines.

ADAPTATIONS FOR ARCHERY

Loss of Function of One or Both Hands

Inability to participate in archery due to paralysis of one hand led to the following solution. An adaption was added to the bow so that the bow's support was borne on the forearm of the affected arm. The other arm and hand were thus free to pull the bowstring.

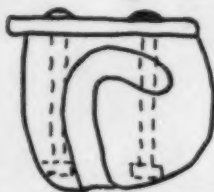


ADAPTED ARCHERY BOW, ILLUSTRATION

Construction of Adapted Archery Bow

- . Cut a 3/16" thick piece of aluminum in the shape of the belly of the bow.
- . Drill holes into the bow so fasteners can be inserted.
- . Bolt the aluminum to the fasteners.
- . Cut and shape a strip of aluminum 3/4" wide by 1/8" thick and the approximate length of the student's forearm.
- . Bolt one part of this aluminum strip to the aluminum attached to the belly of the bow.
- . Adjust the other ends so they fit into the pockets of a leather forearm support made to fit the student's forearm.
- . Use velcro to hold the forearm support snugly in place.

This adapted archery bow was also used for a student who lacked ability to grip with either hand but had use of a prosthetic hook on one hand. A release aid was made to fit the pupil's prosthetic hook which allowed him to pull comfortably and release the bowstring while the adapted bow was secured to the other limb. With both equipment modifications students successfully participated in archery activities with their classmates.



ARCHERY RELEASE AID, ILLUSTRATION

Construction of Archery Release Aid

- . Shape and groove a 3/4" piece of wood.
- . Cut a 3/4" wide by 1/8" thick piece of aluminum approximately 1/8" longer than the wood and place it flush at one end with the wood.
- . Bolt the aluminum piece securely to provide a firm surface from which the bow-string can be pulled back and easily released.

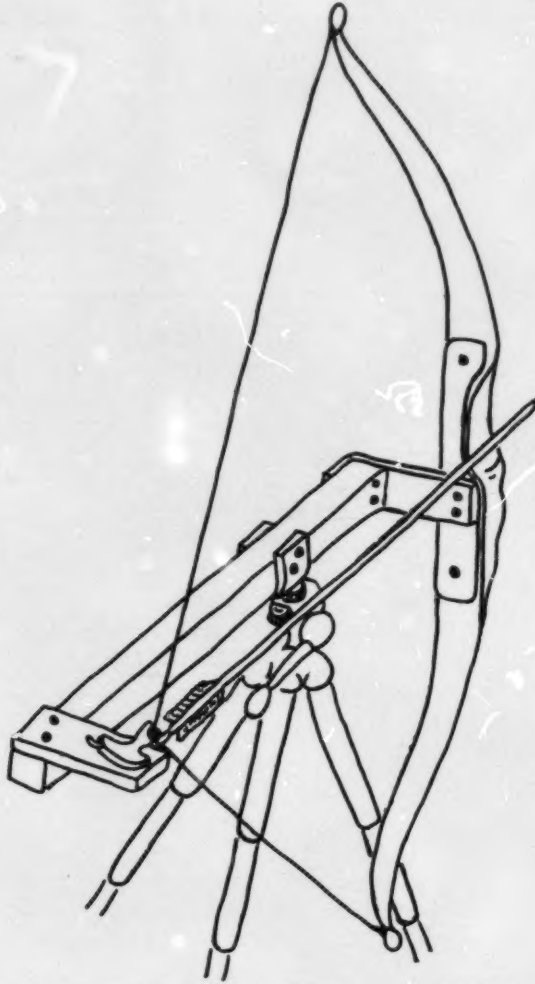
Limited Upper Limb Strength and/or Coordination

A desire to have a teen age boy with muscular dystrophy participate in activities with his peers led to creation of a different type of adapted bow. This student was only able to move forearms, wrists, and fingers independently. A bow was constructed so that after the teacher initially placed the string into a release aid¹ all that was necessary to free the string was slight finger pressure on the trigger of the release aid. This bow was mounted on a camera tripod to allow the student with the help of the teacher to make vertical and horizontal aiming adjustments. This made it possible for the young man to zero-in accurately on the archery target.

Construction of Adapted Bow *(see illustration on page 6).*

- . Cut a 3/16" thick piece of aluminum in the shape of the belly of the bow.
- . Drill holes into the bow so fasteners can be inserted.
- . Bolt the aluminum to the fasteners.
- . Cut a section of wood 1 1/2" by 1 1/2" the approximate length of the draw for a 12 pound pull bow when using a 26" arrow.
- . Shape a piece of 1/8" aluminum to join the 1 1/2" by 1 1/2" strip of wood to the bow.

¹Trade name of this release aid is Hot Shot Release, manufactured by Stuart Manufacturing Company, Rockwell, Texas.



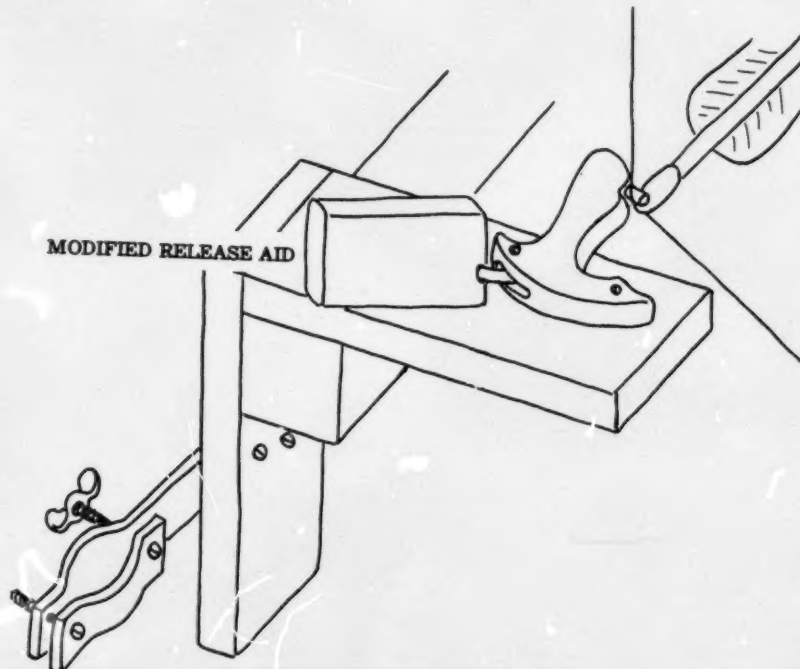
ADAPTED ARCHERY BOW, ILLUSTRATION

- . Bolt one end of the aluminum to the end of the wooden strip and the other to the aluminum that is secured to the belly of the bow.
- . Bolt the release aid to one end of a 3/4" by 2" piece of wood cut to a length which places the release device in a straight line with the bowstring.
- . Bolt the other end of the wood to the 1 1/2" by 1 1/2" wood strip.
- . Locate the center of gravity of the 1 1/2" by 1 1/2" wood strip with bow and release aid attached.
- . Bolt a 1/8" U-shaped piece of aluminum with a camera screw to the bottom of the U and attach it with bolts to the wood strip at its center of gravity. The camera screw provides a means for easily securing the archery bow device to the camera tripod.

A pupil, as a result of cerebral palsy, lacked sufficient upper limb control to hold an archery bow and shoot an arrow. The adapted bow (described above) was used with two modifications--

- . Secure the bow to the student's wheelchair to add stability to the bow in case he accidentally hit it as a result of uncontrolled limb movements.
- . Add a small wooden block to the trigger of the release aid to permit use of a finger for initiating release of the bowstring.

Both modifications encouraged the student to participate actively within his ability.



METHOD OF SECURING ADAPTED ARCHERY BOW TO WHEELCHAIR, ILLUSTRATION

Method of Securing Adapted Bow to Wheelchair

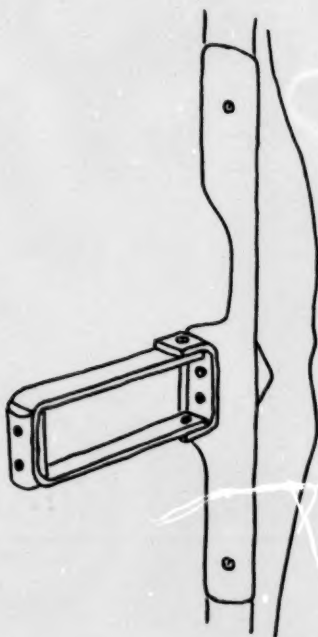
- . Bolt the end of a piece of wood $\frac{5}{8}$ " thick, $2\frac{1}{2}$ " wide, and 8" long perpendicular to the end of the adapted bow frame.
- . Attach a $\frac{1}{8}$ " thick, $\frac{3}{4}$ " wide, and 7" long aluminum strip at a right angle to the wood strip.
- . Secure the bow to a portion of the wheelchair frame by bolting it between this strip and a smaller aluminum strip.
- . Use wing nuts for making this attachment since they permit quick vertical bow adjustments to foster consistency in hitting the target.

Construction of the Modified Release Aid

- . Use a piece of wood $\frac{3}{4}$ " thick, $1\frac{1}{2}$ " wide, and $2\frac{3}{4}$ " long to construct the modified release aid.
- . Drill a hole the same diameter as the trigger into the lower part of one end of the piece of wood.
- . Slip the wood onto the trigger of the release aid.

Upper Limb Absence

A student with almost total absence of his upper limbs wanted to participate in archery. He had functional hands at the end of short appendages. Through experimentation it was noted that this student had sufficient strength and coordination to control a light laminated bow. However, he was unable to pull the bowstring back far enough to generate force required to hit the target. An extended handle was



EXTENDED ARCHERY BOW HANDLE, ILLUSTRATION

*(see instructions for constructing
on page 9)*

attached to the bow to place the bow further from the student and allow him an opportunity to pull the bowstring over a greater distance so as to provide sufficient force for arrows to reach the target. With use, the extended handle has proven to be a very satisfactory bow adaptation.

Construction of Extended Bow Handle

- . Cut a flat sheet of 3/16" aluminum somewhat in the shape of the belly of the bow. Note the shape of the aluminum sheet where the extended handle attaches; this is done to offset the handle so the released string does not hit the student's fingers.
- . Drill holes into the bow so fasteners can be inserted.
- . Bolt the aluminum sheet to the fasteners.
- . Cut, shape, and bolt together two strips of aluminum 3/4" wide by 1/8" thick to form the frame of the handle extension.
- . Bolt the extension to the flat piece of aluminum which has been attached to the belly of the bow.
- . Cut lengthwise into two equal parts a small piece of dowling 3/4" in diameter.
- . Bolt one-half of these pieces to each side of the extension to provide a handle by which the bow can comfortably be held.

ADAPTATIONS FOR BADMINTON

Lack of Body Balance

A high school student requiring crutches to walk could move about with only one crutch on a badminton court. This allowed him a free hand to swing a badminton racket. Periodically when he took a good swing at a shuttle he would lose balance. His first reaction was to place the top of the racket on the floor in an effort to regain body control. However, the racket top would slip on the waxed floor and cause him to fall. To prevent further falls, a strip of rubberized material was attached to the racket top. Then the original handle was removed and replaced with a cane handle to provide greater racket control when it was used as a crutch. With use, this adapted badminton racket proved to be effective in assisting the student maintain body balance and did not detract from his ability to swing the racket.

Construction of Cane Handle Badminton Racket (see illustration on page 10).

- . Saw off the handle portion of a walking cane.
- . Drill lengthwise into the cane handle a hole slightly smaller in diameter than the racket's metal shaft.
- . Remove the original wooden handle from the badminton racket and twist the cane handle onto the exposed shaft.
- . Cut a strip of soft rubber the width of the racket frame and approximately 10" in length.
- . Glue this rubber strip to the top of the cane handle badminton racket.



CANE HANDLE BADMINTON RACKET, ILLUSTRATION

Another student who also needed a crutch to help maintain body balance while playing badminton periodically lost balance while attempting to retrieve a shuttle from the gymnasium floor. By gluing velcro strips² to a shuttle and to the top of the racket, this student was provided a practical means for recovering the shuttle from the floor without likelihood of falling. Addition of the velcro to the shuttle did not seem to affect adversely its flight. See illustration of badminton racket and shuttle with velcro attached on page 11.

²Hollis F. Fait and Jay S. Shivers, Therapeutic and Adapted Recreational Services, Philadelphia: Lea & Febiger, 1975, p. 341.



BADMINTON RACKET AND SHUTTLE WITH VELCRO ATTACHED, ILLUSTRATION

Loss of Function of Both Hands

An adapted racket made badminton a reality for a student with congenital amputations of both upper limbs. Since this pupil used prosthetic hooks to aid her in performing daily living tasks a badminton handle was constructed that could be gripped with one of her hooks. As a result of the adapted racket this pupil developed the ability to rally on a reduced playing area with an underhand stroke. *See instructions for constructing adapted badminton racket on page 12.*



ADAPTED BADMINTON RACKET, ILLUSTRATION

Construction of Adapted Badminton Racket

- . Construct the adapted badminton racket handle from a piece of wood $\frac{3}{4}$ " thick, $2\frac{1}{2}$ " wide, and 4" long.
- . Draw an outline of the hook onto the wooden handle.
- . Use a knife to carve out the hook design to approximately $\frac{3}{16}$ " deep.
- . Drill into the adapted handle a 2" hole slightly smaller in diameter than the racket's metal shaft.
- . Remove the original handle from the badminton racket and twist the adapted handle onto the metal shaft.

Note. The appropriate position for the face of the racket in relation to the adapted handle is determined through practice. This adjustment is made by turning the racket face to the proper angle while firmly holding the handle.

Poor Eye-Hand Coordination

Some students have difficulty hitting a shuttle with a standard badminton racket. By using a racket with a shortened handle the shuttle is brought closer to the student's hand so that greater success is experienced. As each pupil's skill increases, he/she should be encouraged to use a regular badminton racket.



SHORTENED BADMINTON RACKET, ILLUSTRATION

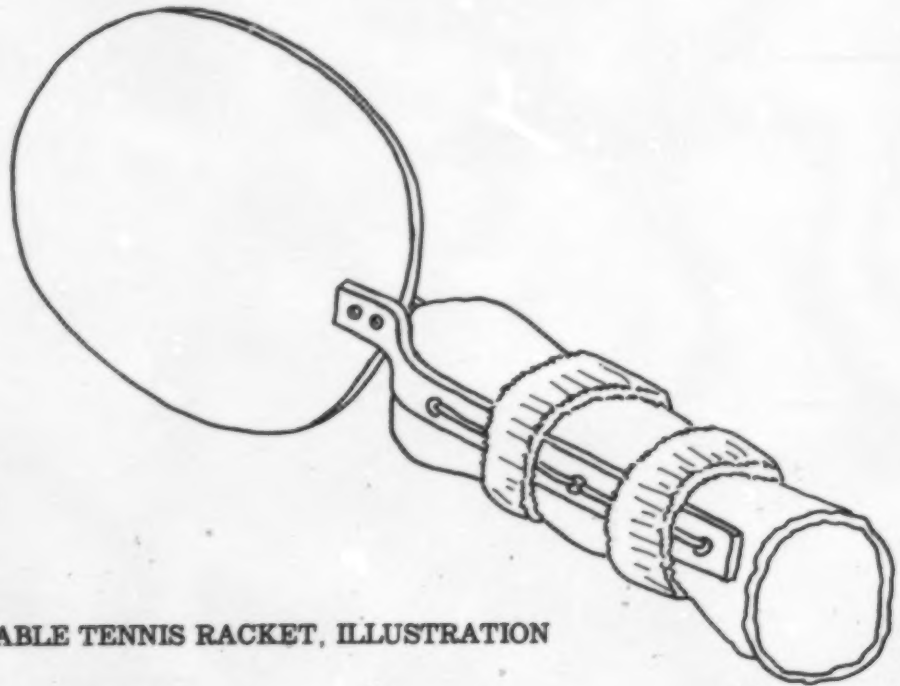
Construction of Shortened Badminton Racket

- . Use a piece of dowling 5" to 6" long and approximately the same diameter as an ordinary badminton handle as the handle for a shortened racket.
- . Drill lengthwise into the dowel a 2" hole slightly smaller in diameter than the racket's metal shaft.
- . Remove the handle of a regular badminton racket leaving $2\frac{1}{2}$ " to 3" of the shaft.
- . Twist the dowel onto the shaft of the racket to complete the shortened badminton racket.

ADAPTATIONS FOR TABLE TENNIS

Loss of Function of Both Hands

A student without fingers on either hand who had a sensitive skin condition was able to participate effectively in table tennis with the aid of an adapted table tennis racket. This adaptation fit onto the student's hand and wrist.

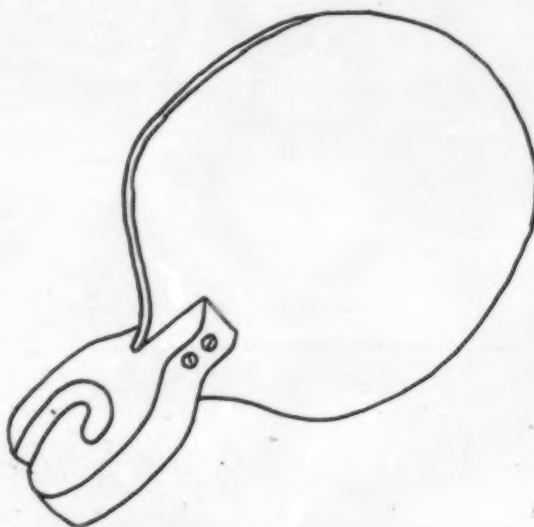


ADAPTED TABLE TENNIS RACKET, ILLUSTRATION

Construction of Adapted Table Tennis Racket

- . Make the hitting surface of the racket from 1/4" plywood.
- . Make the two side supports -- handle -- from aluminum strips 3/4" wide by 1/8" thick and slightly longer than the hand and wrist.
- . Bolt these supports to the racket.
- . Secure a snow mitten of soft quilted material with the thumb removed to the aluminum strips by nylon string.
- . Place elastic strips around the combined aluminum supports and mitten to provide for more secure adherence to the hand and wrist and greater racket control.

A few months into the school year the above mentioned student was fitted with a prosthetic hook for his left arm. Wishing to encourage this student to use the hook in recreational activities, a table tennis bat was constructed as shown below. This bat, as well as the racket described earlier, has been very useful to this student. On days when the student's prosthetic device irritates his skin he uses the racket described earlier; on other days he uses the adapted bat for his prosthetic hook.



ADAPTED TABLE TENNIS RACKET, ILLUSTRATION

Construction of Adapted Table Tennis Bat

- . Make the striking surface from the same material as described above.
- . Bolt to the blade a small handle made from a piece of 3/4" thick wood.
- . Draw an outline of the hook onto the wooden handle.
- . Use a knife to carve out the hook design to approximately 3/16" deep. This adaptation permits the student to hold securely the bat while playing table tennis.

Poor Eye-Hand Coordination

For a few students who had difficulty rallying while using a regular size table tennis ball and racket, a larger ball and bat proved to be effective substitutes. The larger ball was the size of a tennis ball and was made from a spongy foam material.³ The racket was the same shape as a regular bat but with a much larger playing surface. Some students, as their skill increased, were able to use satisfactorily a regular size ball and racket.

Construction of Large Table Tennis Bat

- . Cut from a 1/4" sheet of plywood a large bat with a playing surface of 8 1/2" in width and 11" in length.
- . Glue pieces of wood 5/16" thick, 1 1/8" wide, and 7" long to each side to give body to the handle.
- . Sand the handle to get a rounded surface for ease of gripping.

Lack of Mobility

A student unable to bear weight on one leg sat in a chair to participate in table tennis. He desired to use regular table tennis tables without modifications such as vertical side supports to keep balls on the table. To retrieve a ball when it went out of play onto the floor, a ball retrieval device was of real assistance. With this device the student became proficient in recovering a ball off the floor when it was within twelve feet. To recover a ball the student simply extends the telescopic handle to where the ball is located and rakes the ball to an area accessible for using the retrieval device; using slight pressure he then applies the device to the ball and recovers it. The telescopic handle is quickly retracted and the ball is once again available for continued play. *See instructions for constructing a table tennis ball retriever on page 16.*

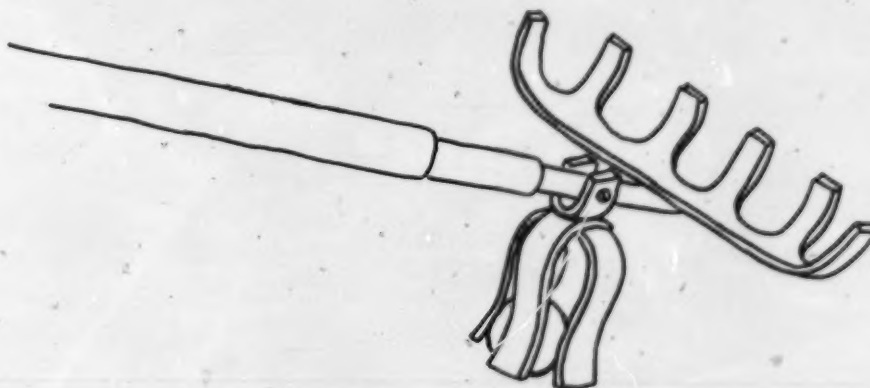


TABLE TENNIS BALL RETRIEVER, ILLUSTRATION

³Trade name of foam ball used was All Ball, distributed by TR Inc., West 2563 Greer Road, Palo Alto, California 94303.

Construction of Table Tennis Ball Retriever

- . Obtain a golfer's rake (used to retrieve golf balls from water hazards) with a 12-foot telescopic handle so that it can be adapted for recovering table tennis balls.
- . Add to the opposite side of the rake the table tennis ball retriever.
- . Make the ball retriever from two pieces of metal cut from a metal band normally used to bundle lumber for shipping; these bands can be obtained from lumber yards.
- . Shape these metal bands with pliers; light bands work very well for this purpose as they hold their shape and retain a springy quality.

SUMMARY

Guidelines for making adaptations has been included to provide practical points to be considered when planning device adaptations. Examples of teacher-made devices have been discussed to demonstrate successful adaptations that have been developed using these guidelines. It is hoped that this information encourages you to use enthusiastically your imagination, resourcefulness, and creativity to develop meaningful adaptations for functionally limited students desiring to experience the joy of participating in meaningful physical education, leisure-time, and sport activities.